National Climatic Data Center

DATA DOCUMENTATION

FOR

DATA SET 6172 (DSI-6172)

NOAA Operational Modeling Archive Distributed System
(NOMADS)
The Global Model and Cycling Analysis Rerun and Retrospective

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1. **Abstract**: The National Weather Service's National Center for Environmental Prediction (NCEP) runs a series of computer analyses and forecasts operationally. One of the primary operational systems is the Global Data Assimilation System, which uses the spectral Medium Range Forecast model (MRF) for the forecast. In simple terms, for each run, unequally spaced conventional and remote sensed observations are assimilated with "first guess" data fields (forecasts from the previous model run), and dynamic imbalances in the data are reduced, resulting in "analyzed" data fields. Then the forecast is made. The analyzed data provides an optimal representation of the real atmosphere on a grid or spectral coefficients of spherical harmonics. These can be compared to observations that have limitations due to measurement error or other instrument problems, and non-uniform spatial and temporal distributions of the observations.

ORIGIN OF DATA

The enclosed rerun/retrospective source data sets contain the NCEP operational ready observation and restart files necessary to begin the Spectral Statistical Interpolation. The collection of observations (conventional and remote sensed) along with the previous model forecasts) which are used as a "guess"), and restart files can be used to rerun the analysis cycling or global forecast system.

NCEP post-processing of model run history using the POST program is used to convert the restart files to pressure coordinate, longitude/latitude GRIB grids. The archiving program extracts 4 times a day minimum restart file set from the NCEP operational communication directory.

The archived data set contains the minimum starting conditions for either the NCEP Operational Spectral Statistical Interpolation (SSI) cycling analysis and/or the Global Spectral Model (GSM). There are two types of files within the data set, Observations and restart files. The observation files are divided into BUFR files and IEEE files. The BUFR files are documented at:

http://www.emc.ncep.noaa.gov/mmb/papers/keyser/data processing

The IEEE files are from remote sensing sources and are in the process of being converted to BUFR. We expect that only experts will access these files directly and this would be done through web based ftp services in the NOMADS system. However, a POST program for converting the model restart files from Spectral coefficients, on sigma vertical coordinate and gaussian grids to latitude/longitude, on standard pressure surfaces will be part of the NOMADS system.

The restart files are binary files that will be of interest to modelers or experts who want to obtain unchanged direct model results, that is, in the models own coordinate. Restart files will ordinarily transformed to pressure coordinate, longitude/latitude, GRIB grid data fields by a program called POST. The POST program is run and the server systems should present the GRIB grid data results transparently to users. A POST program will be supplied and documented elsewhere.

The NCEP Global Spectral Model (GSM) files transmitted to NCDC represent the first operational model restart and retrospective archive. The entire data set of model run history is too large to keep at this time. Thus, we have

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devised the minimum set necessary to regenerate, as closely as possible, an operational run with the NCEP system and allow for other test beds to utilize, run experiments, and other models to initialize from this data set. The data set consists of conventional and remote sensed observations made ready to start NCEP cycling analysis system. Other NCEP operational models in addition to the GSM, such as the Eta and WRF regional models are coming soon. Additional data sets consisting of model run history in GRIB pressure vertical coordinate on a longitude/latitude grid will be present as determined by NOMADS panel.

In addition, using the POST program, the restart files are converted to GRIB data sets. The information contained in restart (in this case GSM sigma files) files represent the final analysis of conventional and remote sensed observations in the models vertical sigma coordinate and spectral coefficients. This file is needed to rerun NCEP models and analysis. The POST program changes this file to standard WMO GRIB containing fields in a pressure vertical coordinate on a longitude/latitude grid. The GRIB data set can be used as a verification set. The conventional and remote sensed observations including quality control are part of the minimum set to restart the analysis cycling system or to start models directly from theses initial conditions.

The analysis, initial condition and predicted fields on the model sigma levels are interpolated to the standard pressure levels in the POST program. The input file consists of the sigma level dependent variables and the output file consists of the pressure level variables in WMO standard GRIB. The file also contains several processed arrays (e.g. boundary layer parameters and tropopause parameters).

2. Element Names and Definitions: The Sigma file Contains (Table 1a) atmospheric variables on sigma surface and model sigma levels as well as topography. This file is the input to the POST program. Fixed fields are found in the Surface file (Table 1b). Normally, the Surface file and Sigma file are for internal use at NCEP and other designated test bed facilities for creating analysis/model reruns. The are made available to modelers and experts in this "raw" form if no interpolations or conversions are needed.

We do not expect that these data sets will be directly accessed at the user level however, modelers and experimenters who wish to examine the analysis and initial conditions without any interpolations can obtain the data through web based ftp.

Table 1a: Structure of a Sigma File

Sigma File (record number)	Contents	Length (bytes)	Type
1	see NMC Office Note 85	32	binary
2	forecast hour	4	real
	initial hour	4	integer
	initial month	4	"
	initial day	4	"
	initial year	4	"
	sigma levels (1)	(KDIM + 1) x 4	real
	sigma layers (2)	KDIM x 4	"
3	Orography in meters (spherical coefficients)	MDIM x 4	"
4	Spherical coefficients of ln (p_s), where p_s is surface pressure (cb)	"	"
5-22	Temperature (K) in model layers 1-KDIM (spherical coefficients)	"	"
23,24	Divergence and Vorticity alternating through layer 1....	"	"
...57,58	....thru layer KDIM	"	"
59-70	Specific humidity in model layers 1-KDIM (spectral coefficients)	"	"

Note all the spherical coefficients are stored in this order: real part, imaginary part, N-S index and E-W wavenumber.

1) Sigma levels are the level starting from σ = 1 at the surface and ending at σ = 0 at the top. Only derived quantities, (vertical velocity, various fluxes) are defined on these levels.

2) Sigma layers are where dependent variables (T, D, ~ , u, v, q) are defined.

Table 1b: Structure of a Surface File

Surface File (record number)	Contents	Length (bytes)	Type
1	see NMC Office Note 85	32	binary
2	Forecast hour	4	real
	Initial hour	4	integer
	Initial month	4	"
	Initial day	4	"
	Initial year	4	"
3	Surface temperature	IDIM x JDIM x 4	real
4	Soil wetness	"	"
5	Snow depth	"	"
6	Sub-surface temperature , layer 1 (TG1)	"	"
7	Sub-surface temperature , layer 2 (TG2)	"	"
8	Sub-surface temperature , layer 3 (TG3)	"	"
9	Surface roughness length	"	"
10	Surface background albedo(1)	"	"
11	Surface-type mask(2)	"	"
12	High cloud fraction	"	"
13	Middle cloud fraction	"	"
14	Low cloud fraction	"	"

Note: All are gaussian gridded arrays of IDIM x JDIM, where I=1 is 0 degrees E (then eastward) and J=1 is near the North Pole (then southward).

(1) Albedo is the background albedo that is modified by snow cover.

(2) Ocean = 0., land = 1., and sea ice = 2.

See Office Note 388 and its supplement (1998) Table 2 "Parameters and Units" pp 45-52 for additional information.

3. **Start Date**: No information provided with original documentation.

4. **Stop Date**: Ongoing.

5. **Coverage**: Global coverage.

   a. Southernmost Latitude: 90S
   b. Northernmost Latitude: 90N
   c. Westernmost Longitude: 180W
   d. Easternmost Longitude: 180E

6. **How to Order Data**:

   Ask NCDC's Climate Services about the cost of obtaining this data set.
   Phone: 828-271-4800
   FAX: 828-271-4876
   E-mail: **NCDC.Orders@noaa.gov**

7. **Archiving Data Center**:

   National Climatic Data Center
   Federal Building
   151 Patton Avenue
   Asheville, NC 28801-5001
   Phone: (828) 271-4800.

8. **Technical Contact**:

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   NOAA/NWS/NCEP/EMC
   5200 Auth Road, Rm. 207
   Camp Springs, MD 20746
   (301) 763-8000 x7205
   http://www.ncep.noaa.gov

9. **Known Uncorrected Problems**: None.

10. **Quality Statement**: No information provided with original documentation.

11. **Essential Companion Datasets**: None

12. **References**:

Kanamitsu, M., 1989: Description of the NMC Global Data Assimilation and Forecast System, Weather and Forecasting, 4(335-342).

Sela, J.G., 1980: Spectral modeling at the National Meteorological Center, Mon. Wea. Rev., 108 (1279-1292).

Additional information on this and other data sets can be obtained via the links above.

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